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Review

Sustainable Supply Chain Management, Performance Measurement, and Management: A Review

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Abstract: The research highlights the importance of sustainable supply chain management (SSCM), technology adoption (TA), and performance measurement in promoting sustainability and improving supply chain performance. By incorporating sustainable practices and utilizing digital technologies, organizations can create a more sustainable future and improve their overall performances. This study conducted an in-depth review of the literature to investigate the presence of TA in SSCM with a focus on digital-based supply chains. The review used both bibliometric and content analysis methods to analyze relevant research articles, with the goal of providing a comprehensive understanding of the current state of research in the field, identifying any gaps in the literature, and providing direction for future research. The content analysis of the literature showed the absence of concrete frameworks for SSCM and the need for clearer and more applicable sustainability measurement indices. To address this gap, the study proposed a framework for achieving sustainable development goals through SSCM. In addition, a framework for deploying sustainability indicators was presented. The proposed framework can be used by practitioners to develop practical and comprehensive measures for their respective industries.

Keywords: sustainable supply chain management; sustainable development; sustainability performance; social responsibility; environmental issues; sustainability

Citation: Kumar, A.; Shrivastav, S.K.; Shrivastava, A.K.; Panigrahi, R.R.; Mardani, A.; Cavallaro, F. Sustainable Supply Chain Management, Performance Measurement, and Management: A Review. *Sustainability* **2023**, *15*, 5290. https://doi.org/10.3390/su15065290

Academic Editors: Idiano D'Adamo and Massimo Gastaldi

Received: 20 November 2022
Revised: 25 February 2023
Accepted: 9 March 2023
Published: 16 March 2023

1. Introduction

The Sustainable Development Goals (SDGs) of 2030 and digital technology are closely interconnected. Digital technology can play a significant role in achieving SDGs by enabling faster and more efficient solutions to global challenges such as poverty, inequality, and climate change. Sustainable business practices or otherwise, though not a new concept, have gained importance with time, looking at the adverse impacts on mother earth and the environment causing a threat to the existence of humankind.

Sustainable supply chain management (SSCM) can facilitate the adoption and implementation of supply chain integration using digital technologies. By incorporating sustainable practices and principles into their operations, organizations can improve their overall supply chain performance, reduce waste, and increase efficiency. Technology Adoption (TA) such as automation, data analytics, and the Internet of Things (IoT) can help organizations to achieve these goals by providing real-time data, facilitating communication and collaboration, and streamlining processes. As a result, suppliers can become more competitive in terms of their operational performance, as they can better meet customer demand, reduce costs, and improve their overall competitiveness [1]. Value creation is essential in sustainable model research and other management fields [1]. This realization

and sustainability awareness are restricted to the manufacturers and across the value chain, both upstream and downstream [2]. Organizations are now more concerned with long-term survival than with competitive advantage. Concerns about supply chain sustainability have grown even in emerging economies. Digitalization can potentially restructure how procurement departments and vendors collaborate in supply chains [3], including sustainability. Sharing and collaboration should be encouraged as a result of digitalization. The role of Industry 4.0 in sustainable supply chain management has been investigated. Most businesses anticipate that digitalization will improve sustainability by utilizing big data analytics for energy management or facilitating chain knowledge transfer [4]. The traditional objective has been to make these elements and the chain efficient to garner higher profits; however, now, the sustainable supply chain is in focus, and Supply Chain Functions (SCFs) emphasize sustainability and profits [5,6] both. With the added dimension of sustainability, environmental, social, and economics in the business, the importance of measuring the performance of the supply chain has grown over recent periods in emerging countries such as India, China, and other Southeast Asian nations [2,7]. Measuring the performance of the supply chain helps firms analyze and improve Supply Chain Performance (SCP) and is an effective tool [8]. SCP is found to be helpful in measuring a business's entire value network within and outside its boundaries.

The Sustainable Supply Chain Management (SSCM) concept has evolved to integrate the supply chain's social, environmental, and financial concerns. A systematic review has been conducted to develop SSCM performance management and set a future research agenda. There are substantial reviews of the literature on SSCM available [9]; however, this study is focused on SSCM and measurement matrices and related management frameworks. A review of the literature is one of the principal methodologies to accumulate better knowledge and understanding of past work and related key issues.

Supply chain management systems use digital technologies to track and optimize the environmental impact of products. Integrating digital technologies with sustainability practices can involve the use of technology to optimize resource usage, reduce waste and emissions, and improve overall sustainability performance. Over time, research is evident that there is the potential for digital technologies to improve sustainability performance in supply chains, while also providing valuable insights and guidance for organizations looking to adopt AI-based technologies.

Digital technologies play a significant role in SSCM. In the area of supply chain management (SCM), digitization has allowed organizations to have a more comprehensive and real-time view of their supply chains, enabling them to make informed decisions and respond quickly to changes in demand and supply. For instance, digitization has enabled organizations to use data and analytics to optimize their inventory levels, improve delivery times, and reduce waste [10].

Moreover, digitization has made it possible for organizations to adopt new business models such as a circular economy, where the focus is on reducing waste, conserving resources, and creating sustainable value. In this context, digitization has enabled organizations to better track and manage the life cycle of products, from raw materials to end-of-life, thereby reducing their environmental impact and promoting sustainability [10]. The Internet of Things (IoT) and big data analytics (BDA) are indeed two of the most prevalent and impactful digital technologies in the current business landscape. The IoT refers to the network of connected devices that can collect and transmit data, enabling organizations to gain real-time insights into their operations and make informed decisions [3]. Blockchain technology has gained significant attention in recent years for its potential to revolutionize supply chain management. Its key features, such as transparency and data sharing, make it well-suited for promoting greater visibility and accountability in the supply chain. This has the potential to help companies identify and address sustainability challenges and improve the overall sustainability of their supply chains [11].

SCM theory suggests that effective management of the four critical elements of the supply chain is essential for ensuring that the supply chain operates efficiently and effec-

tively and that the customer's needs are met in a timely and cost-effective manner. Theory suggests that planning, sourcing, manufacturing, and delivery are critical elements of any supply chain function [12].

Sustainable development is essential for addressing the environmental and social challenges facing the world, and it requires a holistic approach that balances economic, social, and environmental considerations. The goal of sustainable development is to create a more resilient and equitable world for current and future generations (MDG 2015) (http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf (accessed on 20 September 2022)) report, people living in slum conditions are growing worldwide. The World Social Situation report by the U.N. reveals that more than 40% of the world population earns less than 1.25 dollars per day. Sustainability has been defined differently and needs to be conceptualized in totality. Measuring or quantifying sustainable development is the challenge for the day. Therefore, with the growing need for a sustainable supply chain, it is imperative to examine the role and importance of Sustainability Indicator Functions in driving a supply chain's sustainability performance and deploying sustainable indicators.

An extensive review of the literature has been undertaken to address the sustainability measurement issues from a different perspective of a supply chain and connect sustainable development goals through sustainable supply chain management by its various stockholders, such as employees, buyers, sellers, government, and society. The integration of digital technology and SSCM has the potential to revolutionize the way companies manage their supply chains, enabling them to create more sustainable, efficient, and responsible supply chains. As companies continue to adopt digital technologies, it is likely that the role of SSCM in supply chain management will become increasingly important, leading to greater sustainability and a more responsible and sustainable future.

There is less time to come up with answers to sustainability problems; no one has a clear understanding of how much the issue has actually impacted society and business [13]. In this paper, the authors made an attempt to identify the novelty of the study related to (1) the sustainability and digital supply chain (DSCM) prospectus of TA and (2) how the adoption of technology related to DCM business can achieve SSCM. There is little research that evidences digital technologies' potential impact on supply chain sustainability. These aspects highlight the need for further research to better understand the intersection of sustainability and digital technologies in supply chains and to develop practical guidelines for their effective integration.

Based on the above discussion, this study investigates the following research questions (RQ) to set future research direction:

RQ 1. How can organizations effectively integrate digital technologies and sustainability practices to create more sustainable and environmentally responsible supply chains?

RQ 2. What are the best practices for deploying the sustainability functions of a supply chain?

RQ 3. How can blockchain and other digital technologies help improve supply chain transparency and enhance sustainability performance?

2. Materials and Methods

The systemic review conducted by [14] aimed to establish a link between Sustainable Supply Chain Management (SSCM) and sustainable development, digital enablers, and supply chain management [10]. The review used the Scopus database and searched for articles using the keywords "Sustainability and sustainable supply chain management" and "Digital Supply chain" from 2011 to 2022. A total of 543 articles were reviewed out of 989. The review aimed to provide insights into the current state of research on SSCM and its association with sustainable development. The results of the review could be used to inform future research and guide organizations in their efforts to adopt sustainable supply chain practices.

A systemic review has been conducted to establish an association between Sustainable Supply Chain Management (SSCM) and sustainable development [14], sustainable supply chain management, and food company performance with linking to quality assurance [15]. The review on Sustainable Supply Chain Management and Digital Transformation [3] literature has been searched using the keywords sustainability and sustainable supply chain management and digital supply chain on the most widely accepted and accessed data source, i.e., Scopus database during 2011–2022. A total of 543 articles have been reviewed out of 989 articles.

A reliability test for content analysis has been carried out using the method proposed by [16] in SPSS. The alpha value of the test result was 0.83, which is acceptable. The frequencies of different sustainability themes in supply chain management are listed in Figure 1 (the x-axis represents the frequency of words).

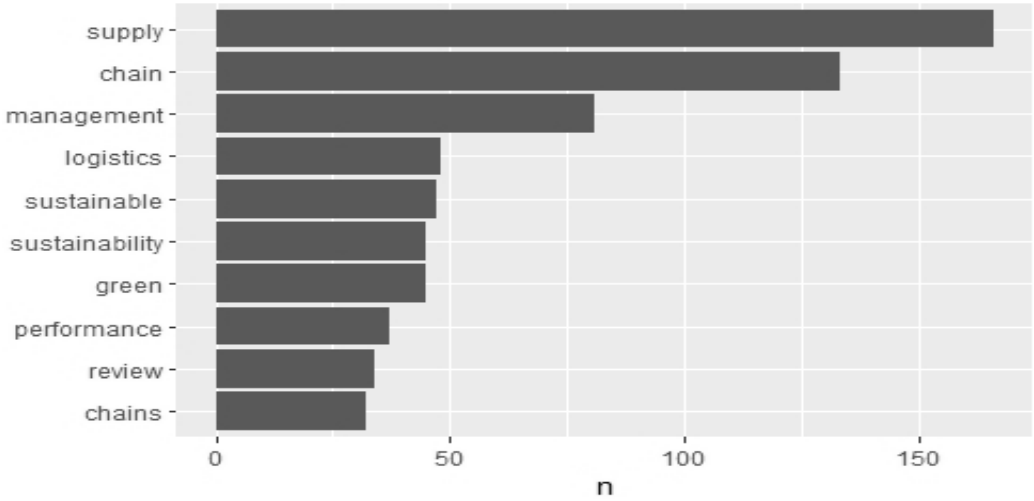

Figure 1. Frequency of keywords in reviewed papers.

2.1. Descriptive Statistics of the Reviewed Papers

For our supply chain management research, we rely on Scopus because of its comprehensive coverage of peer-reviewed studies [17]. Now that we have been exposed to newer research, we use the most commonly used keywords [18–20]. Table 1 shows our systematic approach to compiling the final data sets of five hundred forty-three research papers. In the realm of academic research in quantitative science studies, Scopus serves as a content-rich and comprehensive bibliometric data source [21]. The Scopus database has increased interest more than the WOS and PubMed data sources of its worldwide access and diverse research platform [22]. So, the bibliometric analysis of this study is conducted using the Scopus database. Due to the initial manuscript being retrieved from the Scopus database via software, bibliometric and bibliographic information have also been utilized [17]. When such documents are converted without first cleaning the data, there is the risk that an unsupported assertion will be made. Thus, we examine the data's references to clean it up. This course of action is made possible by the expansion, visualization, and comprehension of bibliographic data [23]. To obtain the above-filtered data, we used the search words "sustainability" and "sustainable supply chain management".

Table 1. The summary statistics of literature used for bibliometric analysis are listed below.

Filtering Criteria	Reject	Accept
Search parameters.		
Search engine: Scopus		
Date of data Extraction: 28 June 2022		
Author's keywords: ("sustainability" AND "sustainable supply chain management")		989
Subject area: "Business, Management and Accounting", "Economics", "Econometrics and Finance", "Social Sciences", "Decision Sciences", and "Environmental Science".	158	831
Search year: 2011–28 June 2022	30	801
Language screening: "English".	4	797
Document type: "Articles", "Book",	188	609
Publication state: "Final" and "Article in the press".	40	569
Content screening: Include articles if "Titles, abstracts, and keywords" indicate relevance to the scope of the study (i.e., sustainable supply chain management)	26	543
Authors of single-authored documents	-	1000
Minimum two documents as an author with one citation	-	222

Note(s): Table showing the last collection of (543) articles from the Scopus database.

The annual percentage growth rate of the studied literature was 56.7164. Sustainability Switzerland (76 publications), the Journal of Cleaner Production (66 publications), the International Journal of Production Economics (22 publications), Business Strategy and The Environment (19 publications), Resources Conservation and Recycling (18 publications), Supply Chain Management (15 publications), International Journal of Operations and Production Management (13 publications), and International Journal of Production Research and Transportation Research Part E Logistics And Transportation Review (11 publications) are among the top contributors (10 publications each) to the Forum on the Supply Chain (07), as shown in Figure 2.

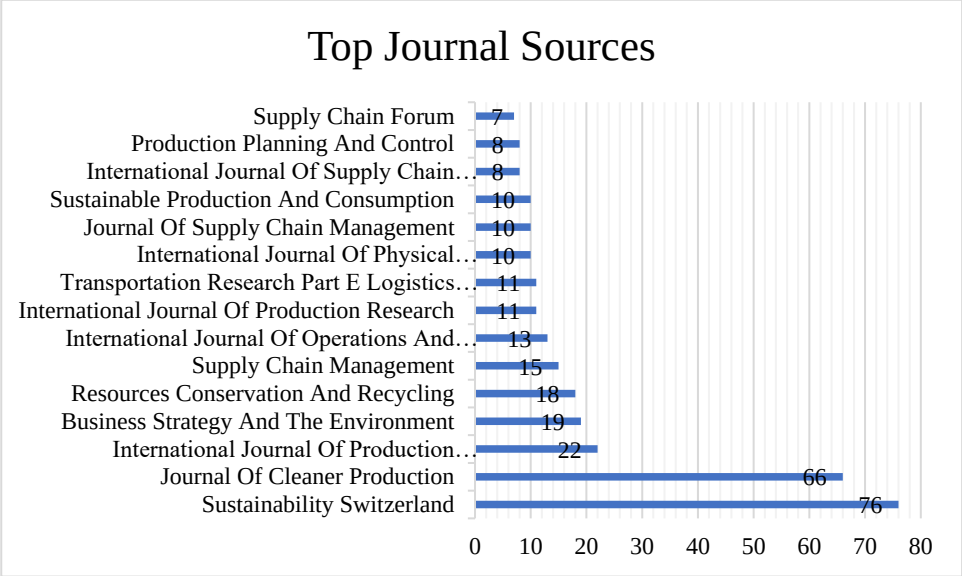

Figure 2. Statistics of reviewed papers from top journals.

The environmental dimension of supply chain management has a higher correlation (72.48%) with sustainability, followed by economic (70%) and sustainable supply chain (56%) dimensions, as shown in the correlation-based network diagram of keywords in

Figure 3. The year-wise distribution of papers reviewed is presented in Figure 4, which indicates a sudden (almost double) increase in the articles published in this area from 2011 to 2012 and demonstrates that the topic has gained paramount importance in the past few years. The tools and methods for reviewing papers are classified in Table 2.

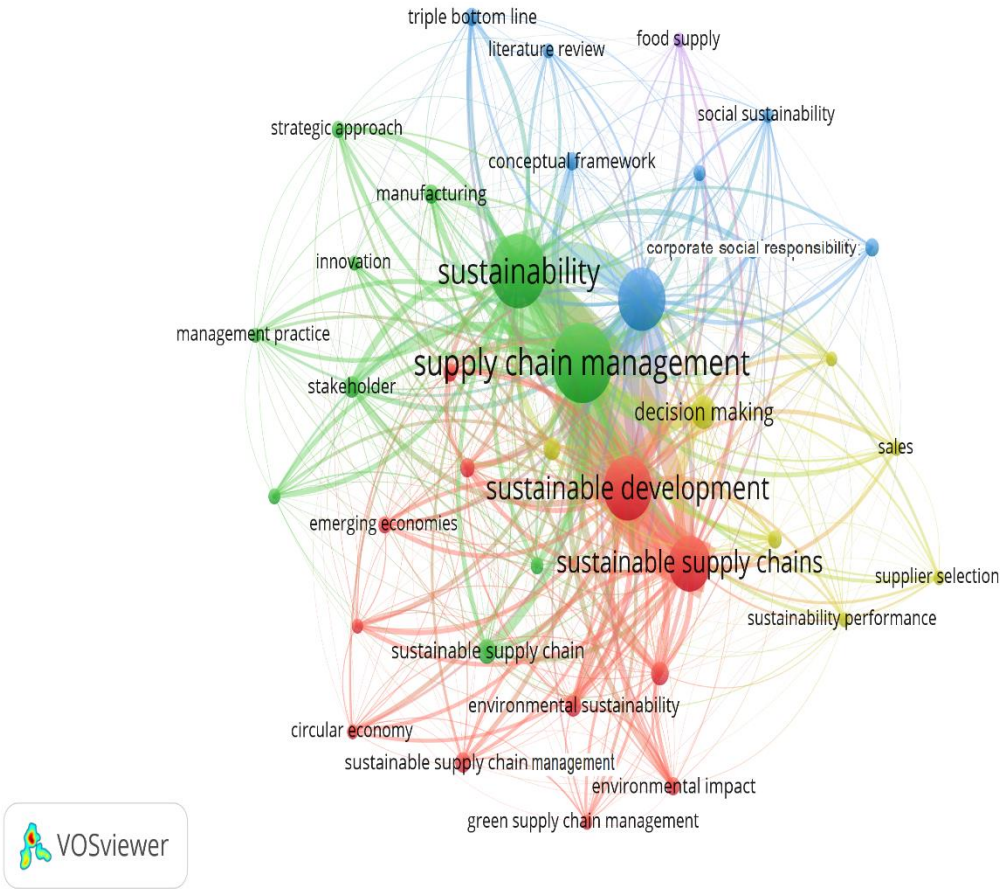

Figure 3. The directed network of supply chain management, sustainability, sustainable development, sustainable supply chain management, and sustainable supply chains dimensions in the reviewed literature.

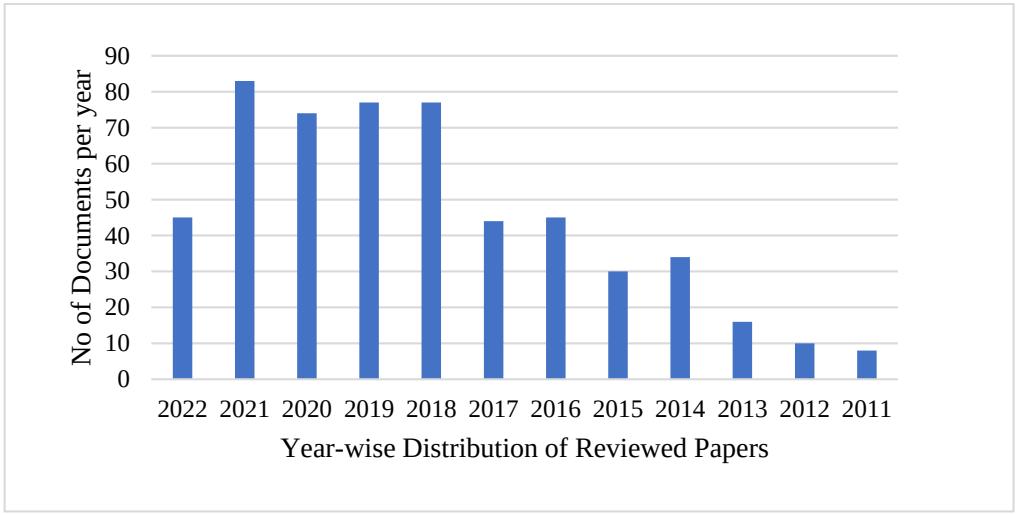

Figure 4. Year-wise distribution of reviewed papers.

Table 2. Methods used for performance measurement/management in the reviewed papers.

Tools/Methods	Papers	Counts
AHP, AHP-QFD, FAHP, QFD-SFD	[24–33]	16
Balance Score Card, Association Rule, Bibliometric Network Analysis	[34–40]	12
BSC, Fuzzy Delphi Method (FDM), Fuzzy MCDM, Fuzzy-Based DEMATEL, Grey-Based MCDM, Fuzzy ANP	[41–48]	23
Content Analysis, Econometric Method, Conceptual Framework, Empirical Study and Modelling, Data Analysis, Inferential Statistics	[3,8,49–93]	64
DEA, ISM, LCA, EIO, VCA, Matrices, Factor Analysis	[53,59,76,94–110]	18
Quantitative Modelling, TBL, Simulation, and Modelling, Social Network Analysis	[39,111–120]	22
Qualitative Framework, Grey-Based SCOR, MCDM, CFA, Complexity Analysis, MILP, Bibliometric Analysis	[35,121–129]	17

2.2. Inferential Statistics

The study undertakes content analysis for data synthesis and identification of emerging themes, which was considered the most reliable approach for this kind of study, as suggested by [130]. Content analysis has been performed among 543 reviewed articles to verify that Sustainable Supply Chain Management positively supports sustainability (Figure 5).

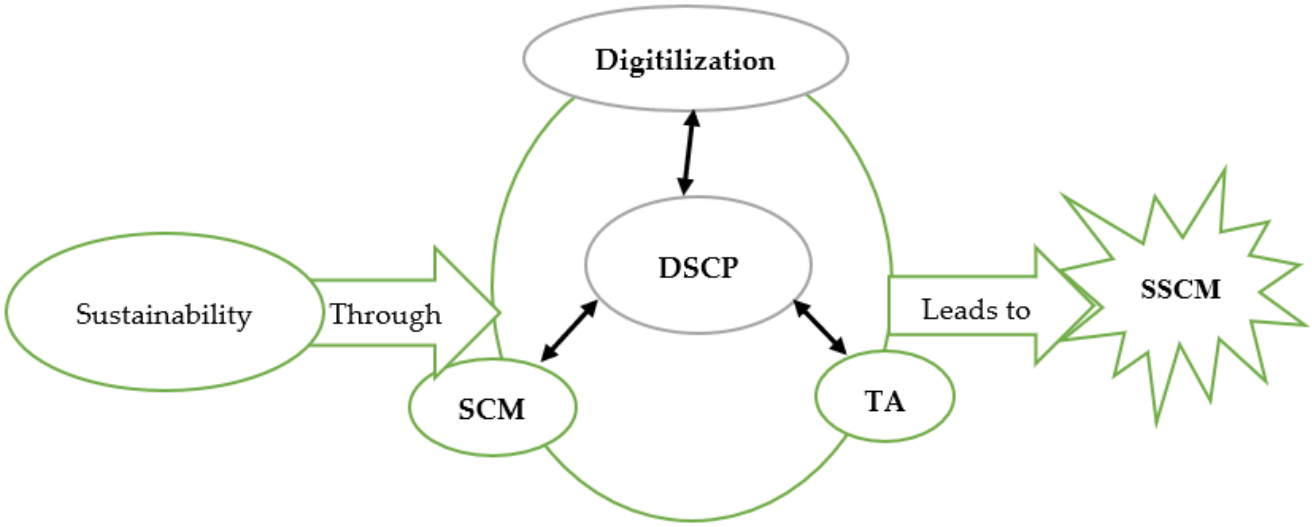

Figure 5. Directional relationship between Sustainability and SSCM. Model referred from [131].

From text analytics, we generate the directional network as shown in Figure 3; 48.96 percent of the reviewed literature has taken all three dimensions of sustainability; therefore, it is legitimate to test the stated hypothesis among 48.96 percent of the literature [132]. Out of 71 pieces of literature with all dimensions of sustainability, 43 noted a positive association between sustainable development (SD) and SSCM, while 10 stated negative and 18 said nothing about sustainability. Of 543 pieces of literature with at least one sustainability dimension, 73 endorsed a positive association between sustainability and SSCM. Most of the reviewed literature has supported the positive association between SD and SSCM. The reviewed literature has also indicated increased citations on sustainability science. Theorists of SSCM should seek out those institutional entrepreneurs who actively reshape the institutional conditions in which they are situated [133].

Establishing a relationship between SSCM practices and sustainability performance management has been challenging. The authors have tested the association between SSCM practices and sustainability performance with widely stated variables in Table 1. The principle SSCM methods, such as green procurement, green manufacturing, green distribution, green logistics, and recycling, were tested for association with sustainability performance (economic performance, environmental performance, and social performance). The Chi-square association test shows a relationship between SSCM practices and sustainability performance (Tables 3–5). The *p*-value of the test is more than 0.05, which shows the strong relationship between SSCM practices and sustainability performances. SSCM has become an increasingly complex and globally accepted phenomenon in the area of sustainability [31,134]. Global supply chains face difficulties assessing their performance if the multidimensional and transnational aspects are ignored (GSCs) [135].

Table 3. Cross tabulation results.

Sustainable Supply Chain Practices × Sustainability Performance Cross Tabulation					
Count					
		Sustainability Performance			**Total**
		Economic Performance	**Environmental Performance**	**Social Performance**	
Sustainable Supply Chain Practices	Green Distribution	40	30	33	103
	Green Logistics	30	35	34	99
	Green Manufacturing	35	40	30	105
	Green Procurement	29	42	40	111
	Recycling	45	45	35	125
Total		179	192	172	543

Table 4. Chi-Square test results.

	Value	**Def**	**Asymp. Sig. (Two-Sided)**
Pearson Chi-Square	7.342 [a]	8	0.500
Likelihood Ratio	7.469	8	0.487
No. of Valid Cases	466		

[a.] 0 cells (. 0%) have an expected count of less than five. The minimum expected count is 26.50.

Table 5. List of sustainability indices.

S.No.	**Index**	**Acronym/Institution**
1	EPI	Environmental Performance Index
2	NRMI	Natural Resource Management Index
3	H.F.	Human Footprint
4	GRI	Global Reporting Initiatives
5	GPI	Genuine Progress Index
6	DJSI	Dow Jones Sustainability Index
7	CSD	Commission on Sustainable Development
8	Dashboard	Developed by Consultee Group of Sustainable Development Indicators
9	Barometer	Developed by the World Conservation Institute
10	TBL	Triple Bottom Line Index
11	Ethos	Corporate Social Responsibility Indicators
12	IChemE	Institute of Chemical Engineers

2.2.1. Sustainability and Supply Chain Management

This study conducted a structured review to determine whether millennium development could be achieved through Sustainable Supply Chain Management (SSCM). The word sustainable development indicates the participation of every member of society in economic activity. [136] have advocated traditional farming systems and other activities such as craftsmanship (e.g., manufacturing and local food production), which essentially lead to human integration with nature. The Common Agricultural Policy (CAP), formulated in Europe, challenges participatory planning and attitudes toward traditional work. Participatory economic activity and collaboration are significant indicators of sustainable supply chain management; a few examples, like AMUL and GOPALJEE dairy supply chains from India, could be stated in support of the argument. The human race has endless needs, and to satisfy these needs, a supply chain management system has been developed and defined with linkages (networks) for different human activities. Therefore, researchers must address those endless needs legitimately for the sustainable development theory. A system view of supply chain management is shown in Figure 6, followed by a process view of the supply chain and SSCM process in Figures 7 and 8.

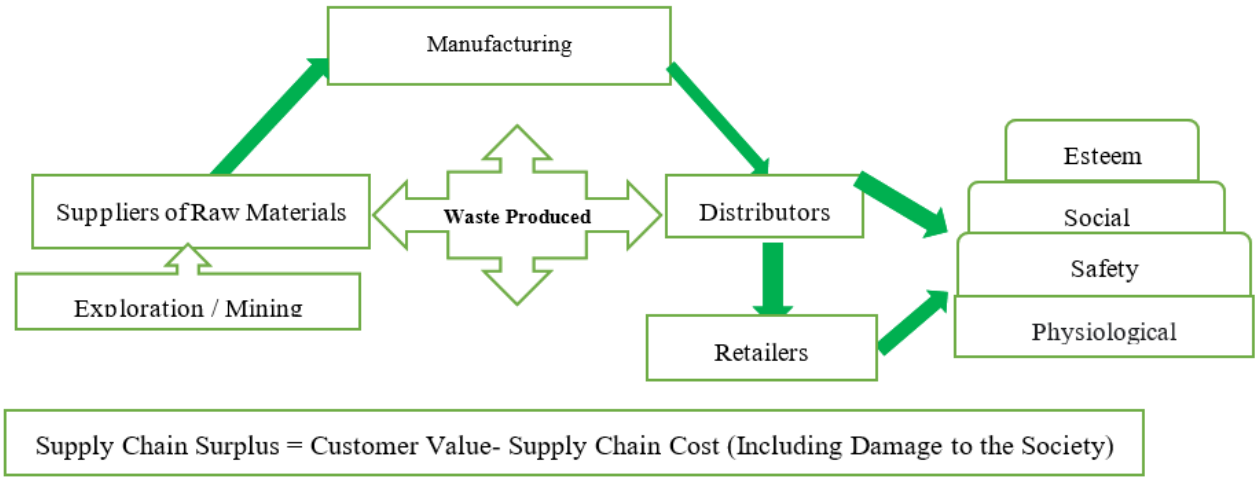

Figure 6. A simple supply chain.

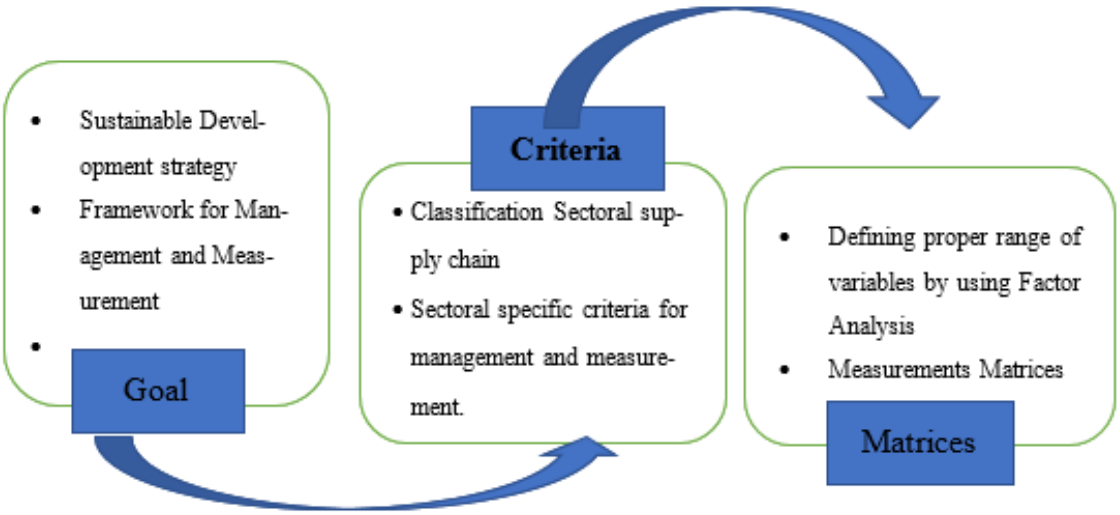

Figure 7. SSCM process.

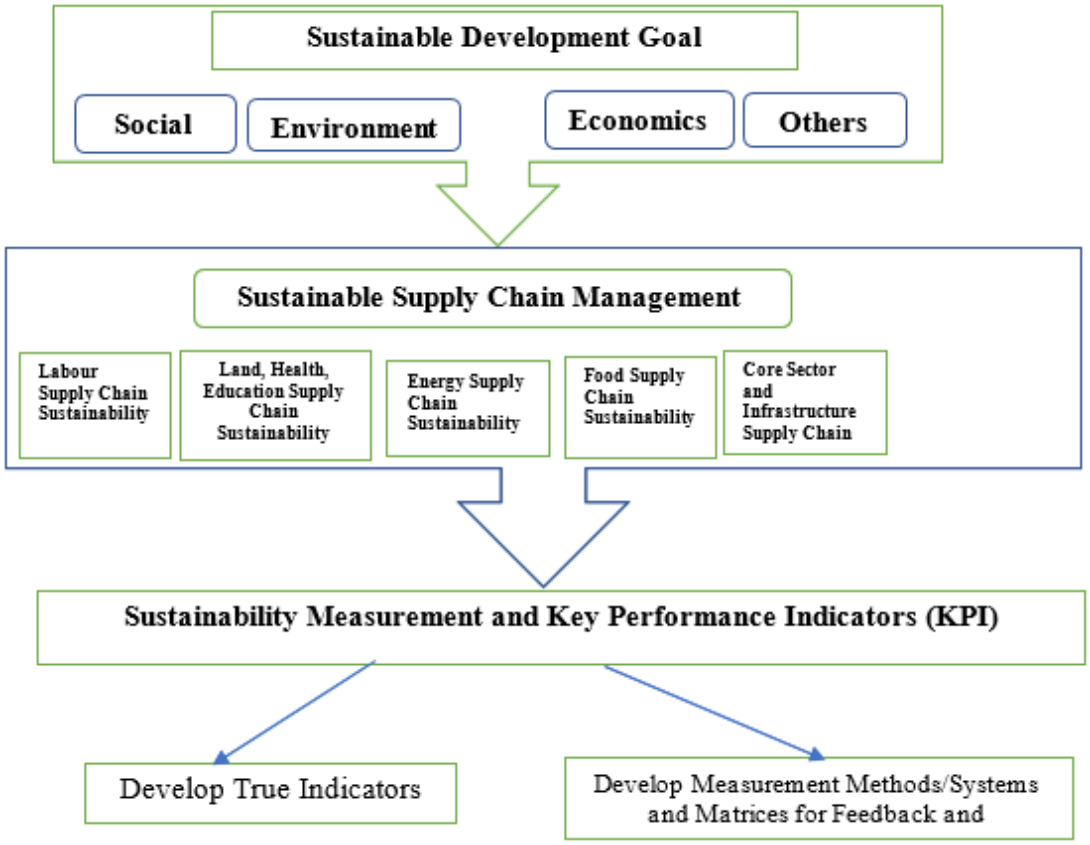

Figure 8. Process view of attaining sustainable development through SSCM.

The objective of a supply chain is to maximize supply chain surplus, which is defined by the following:

Supply Chain Surplus = Customer value—Supply Chain Cost

The value of the product or service fulfilled by a supply chain may vary according to the need. Therefore, for sustainable supply chain management, supply chain costs should be minimized; costs may function as environmental, social, and economic concerns, including waste produced, carbon emission, etc.

2.2.2. Sustainability and Digital Supply Chain Management (DSCM)

Sustainability and digital supply chain management (SCM) are closely related concepts that can be used to improve the overall efficiency and impact of businesses. Sustainability refers to the responsible use of resources [131], the reduction of negative environmental impact, and promotion of social well-being. Digital solutions can provide visibility and traceability in the supply chain, enabling companies to make more informed decisions and better assess the sustainability of their suppliers and operations [136]. Digitizing the global value chain has grown significantly [131]. Digital transformation leveraging sophisticated technologies like cloud computing, big data, and blockchain simplifies and accelerates supply chain integration [131] with Industry 4.0. By integrating materials and information and synchronizing inter-organizational activities, firms have tried to improve supply chain operations by collaborating with suppliers and customers [137]. It is important for companies to have a clear and comprehensive understanding of the potential benefits and risks of digitization and to develop effective change management strategies to ensure successful adoption.

Table 5 shows the different measurement indices used for measuring sustainability [138]; most companies use these indices for their sustainability initiatives. [139] argued

that these indices have failed to provide a minimum acceptable level of indicators. Using these indices in the deployment of sustainability indicators is also unclear.

The authors have surveyed sustainability initiatives of the top ten Fortune 500 companies, as listed in Table 6. The sustainability reporting initiatives contain CSR as well. CSR initiatives are now reported and designed as sustainability programs for companies. The shift from CSR to sustainability reporting is evident in Table 6. Sustainability reporting practices are random; they should be structured and contain concrete evidence of sustainability initiatives.

Table 6. Sustainability reporting program initiatives from top 10 Fortune 500 companies.

Rank	Company	Website	Sustainability Initiatives		
			Social	**Environmental**	**Economic**
1	Walmart Stores	www.corporate.walmart.com	The Walmart Foundation meets the needs of the under-served by directing charitable giving toward our core areas of focus: Opportunity, Sustainability, and Community.		
2	Exxon Mobil	www.exxonmobil.com	Malaria, corporate citizenship, human rights, local Economic development, Indigenous peoples, cultural heritage and diversity, land use and resettlement, transparency and corruption, community relations	Air emissions reductions, ecosystem services, environmental drilling initiatives, environmental stewardship, freshwater management, managing arctic resources, site remediation, spill performance	Environment and safety, operations, policy, technology, flexibility, energy efficiency
3	Chevron	www.chevron.com	Health, education, volunteerism, freshwater	Freshwater, biodiversity	Energy efficiency, land management, IPIECA/API/OGP reporting standard
4	Berkshire Hathaway	www.berkshirehathaway.com	Investors health		
5	Apple	www.apple.com	Environment, supplier responsibility, accessibility, privacy, inclusion and diversity, education, reuse and recycling		
6	Phillips 66	www.phillips66.com	Operating excellence, people, transparency & accountability, community investments, supplier diversity, governance & ethics, environmental metrics.		
7	General Motors	www.gm.com	Sustainability considers environmental, social, and economic opportunities and supports the long-term success of our company. Value is created through top-line growth opportunities, bottom-line improvements, and risk mitigation. Our customers drive how much weight is designed—everything starts and ends with our customers. At G.M., we view sustainability as a business approach that makes long-term stakeholder value. It is an approach executed by every function at every level of our company.		
8	Ford Motor	www.ford.com	Investors health		
9	General Electric	www.ge.com	At G.E., Sustainability means aligning our business strategy to meet societal needs while minimizing environmental impact and advancing social development. This commitment is embedded at every level of our company.		
10	Valero Energy	www.valero.com	Social health and safety, community, valero benefit of children, volunteerism, employee benefit	Environmental matrices, environmental awards	Investors, financial reports, filings & statements, industry fundamentals, investor faqs

3. Measurement of Sustainability and Its Indicators

Today, sustainable development and equitable growth are extremely important. The authors discovered evidence and a link between Sustainable Supply Chain Management and Sustainable Development, as indicated in the research question. The United Nations General Assembly approved a set of global Sustainable Development Goals (SDGs) consisting of 17 goals and 169 targets. In addition, in March 2015, an initial set of 330 indicators was introduced. Some SDGs were based on previous Millennium Development Goals, while others were based on fresh ideas. A rigorous examination of these indicators was conducted by [140].

Many researchers have indicated the sustainability of the energy supply chain, infrastructure needs, road, and transports mechanism could enhance inclusive growth [141–145]. A few researchers have tried to capture sustainability matrices for measurement. Refs. [53,146] have personated a well-structured review of different sustainability measurement indices and frameworks such as GRI, IChemE, DJSI, CSD, Dashboard, Barometer, TBL, and Ethos. While measuring and managing the performance of sustainability, the following questions need to be answered, as discussed by [138]. Ref. [138] have discussed performance measurement and management tools in SSCM, and the same, with some additions, which are presented in Table 7.

- What type of performance is being measured in SSCM?
- Which indicators should be used?
- Who is measuring performance?
- What type of SSCM Performance Measurement indicators and methods will be used by which business sector?

Table 7. Overview of performance measurement and management tools in SSCM.

	Social	Environmental	Economic	Other	Integrative
Tools	Social LCA, Social Audit, Social Benchmarking, Stakeholder Dialog, Social Reporting	Life Cycle Assessment (LCA), Eco-audit, Environmental Benchmarking, Environmental Reporting	Cost-benefit Analysis, Economic Input–Output Analysis, Financial Reporting, Risk Analysis	Transparency Deployment, Quality Sustainability, Role of I.T. in Sustainability	Sustainability Audit, Sustainability Benchmarking, Sustainability Reporting
Concept	Corporate Citizenship	Design of the Environment	SCOR Framework, Financial Audit	Digitalization	Sustainability Balanced Scorecard (SBSC)
System	Social Management System (SMS) Occupational Health and Safety	Environmental Management System (EMS)	Quality Management System(QMS)	Yet to be Developed	Integrated Management System
Standard	SA 8000(SMS), OHSAS 18001 (OHS)	ISO 14001 (EMS), ISO 14040 (LCA), ISO 14064	ISO 9001 (QMS)		Global Reporting Initiatives (report), U.N. Global Compact

3.1. Social Indicators

A reference model for social sustainability measurement has been proposed by [146] that indicates the dimensions and level of sustainability measurement. The reference model proposed could be linked to the sustainable social supply chain management model, as suggested in Figure 9. A list of social sustainability indicators is presented in Table 8.

Table 8. Social Indicators of SSCM.

S.No.	Indicator	Description
1	Workforce participation	Describe joint management and workforce health and safety programs and processes to facilitate the crew's participation in health and safety dialogues at all levels.
2	Workforce health	Describe programs and processes for identifying and addressing significant workforce health issues, especially at the community and country levels.
3	Occupational injury and illness incidents	Report health and safety data on workforce injuries or illnesses resulting from occupational incidents.
4	Product stewardship	Describe the company's approach to assessing and communicating product health, safety, and environmental risks.
5	Process safety	Report the number of Tier 1 process safety events (an unplanned or uncontrolled loss of primary containment) with a narrative and report per business activity (refining, upstream, etc.).
6	Local community impacts and engagement	Describe policies, strategies, and procedures to understand and address local community impacts and engage with affected stakeholders.
7	Indigenous peoples	Describe policies, programs, and procedures to engage with indigenous peoples and address their concerns and expectations.
8	Involuntary resettlement	Describe policies, programs, and procedures related to involuntary resettlement.
9	Social investment	Describe strategies, programs, and procedures relating to social investment and its effectiveness.
10	Local content practices	Describe policies and practices related to local content.
11	Local hiring practices	Describe the company's approach and programs for providing employment opportunities to residents of host countries.
12	Local procurement and supplier development	Describe the company's programs and processes to improve the ability of local suppliers and contractors to support operations and carry out projects.
13	Human rights due diligence	Describe policies, programs, and procedures the company has in place to respect human rights—including workers' rights—in its operations.
14	Human rights and suppliers	Describe policies, programs, and procedures to promote respect for human rights by suppliers.
15	Security and human rights	Describe policies, programs, and procedures related to security and human rights.
16	Preventing corruption	Describe policies, programs, and procedures to prevent bribery and corruption and monitor compliance.
17	Preventing corruption involving business partners	Describe anti-corruption policies and procedures for business partners, including suppliers and contractors.
18	Transparency of payments to host governments	Describe policies, initiatives, or advocacy programs to promote revenue transparency.
19	Public advocacy and lobbying	Describe the company's approach to managing public advocacy, lobbying, and political contributions.
20	Workforce diversity and inclusion	Describe policy and procedures promoting diversity and inclusion.
21	Workforce engagement	Describe policies, programs, and procedures on engagement and workforce satisfaction.
22	Workforce training and development	Describe policies and procedures for providing workforce training and development opportunities.
23	Non-retaliation and grievance system	Describe the non-retaliation policy and confidential workforce grievance system.

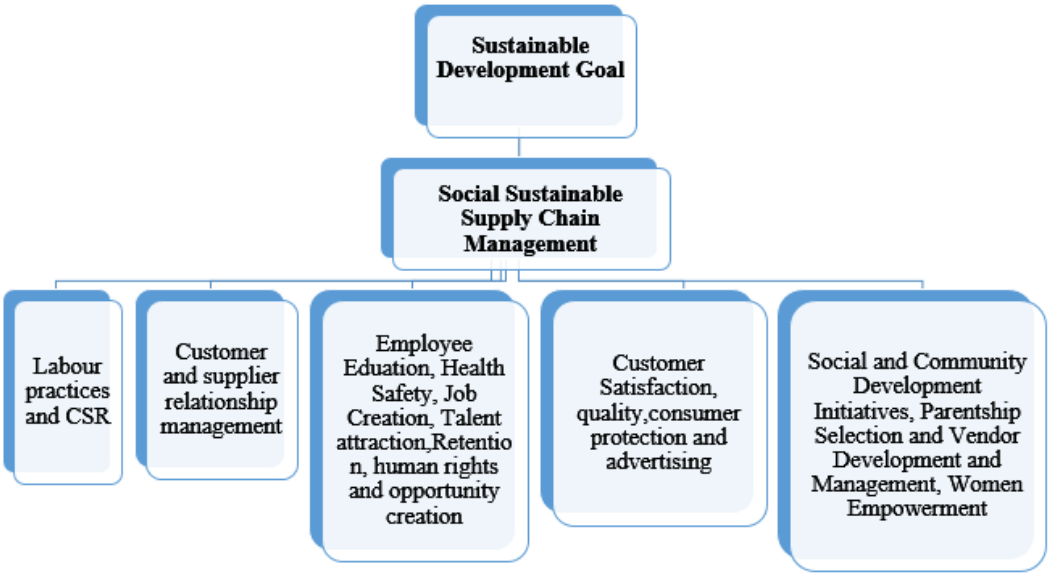

Figure 9. Social framework of sustainable development using SSCM.

3.2. Environmental Indicators

The concept of 'Green Supply Chain Management (GSCM)' was introduced to include environmental concerns of the supply chain, and plenty of scholarly studies and formulations have been carved out in this area. The significant ideas from these studies are remanufacturing, recycling, green production, waste management, green energy, reverse logistics, etc. [99]. A sustainability reporting framework is proposed (Figure 10) based on the content analysis of the reviewed literature. A list of Contemporary Environmental Indicators is identified in Table 9.

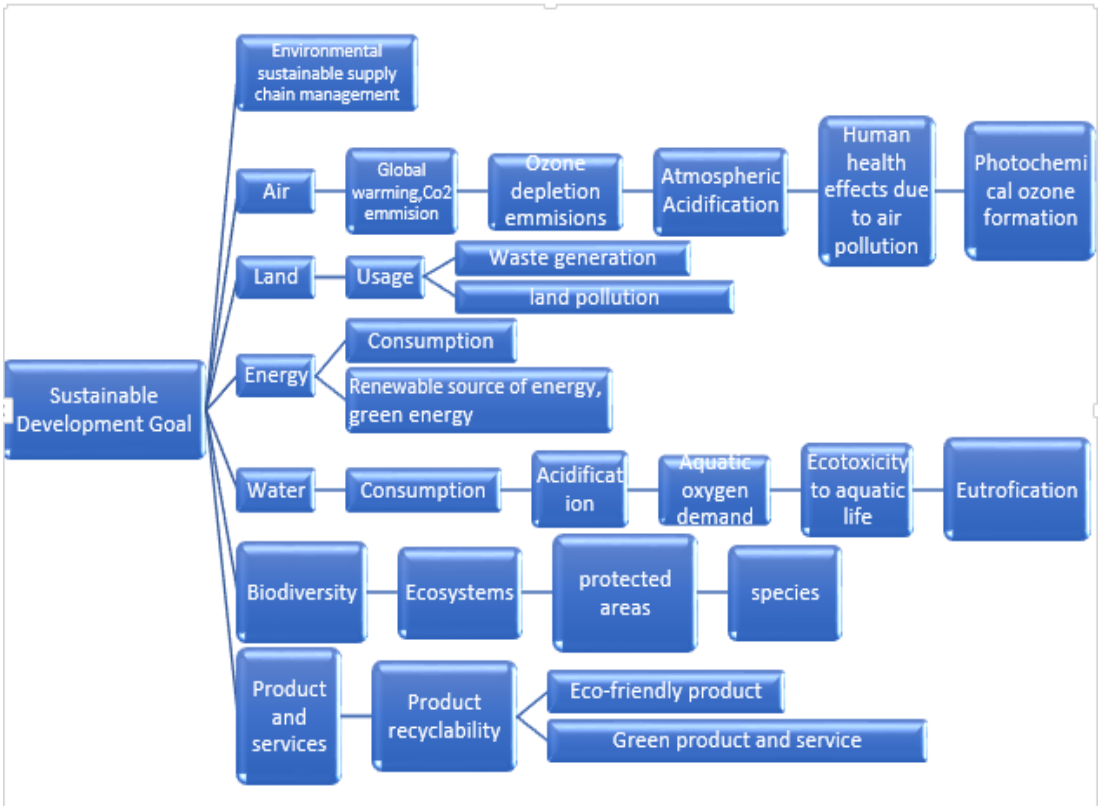

Figure 10. Environmental framework of sustainable development using SSCM.

Table 9. Environmental indicators of SSCM.

S.No.	Indicator	Description
1	Natural recourse management	Report the effective use of natural resources
2	Land management and greenery	Report the effective use of land
3	Environmental governance	Report environmental awareness
4	Energy management	Report the effort to use renewable energy
5	Greenhouse gas emissions	Report the quantity of greenhouse gas emissions from combustion and other processes, including carbon dioxide and methane
6	Eco-efficiency	Report total energy consumed in oil and gas operations or other business activities
7	Alternative energy sources	Report qualitatively on company research, plans, or current initiatives related to alternative or renewable energy sources
8	Flared gas	Report the quantity of hydrocarbon gas flared into the atmosphere from operations
9	Biodiversity and ecosystem services	Qualitatively describe how the company addresses risks and opportunities related to biodiversity and ecosystem services
10	Freshwater	Report the quantity of freshwater withdrawn or consumed by operations
11	Other air emissions	Report quantities of emissions to the atmosphere from operations
12	Spills to the environment	Quantify spills to the environment from operations and describe significant falls and response measures
13	Discharges to water	Quantify hydrocarbon discharges to a water environment from operations
14	Waste and recycling	Report quantities of waste disposed of, resulting from operations and methods of recycling
15	Environmental health	Report the health of the air, water, and land

3.3. Economic Indicators

Economic efficiency has been the primary performance criteria for a supply chain that includes cost, service, and operational efficiencies until the emergence of Supply Chain Management, Global Commodity Chains, Global Value Chains, and Global Production Networks [54]. After 2000, a sudden increase in the literature on sustainability and a worldwide debate on sustainability has forced supply chain planners and designers to design holistic performance criteria in sync with economic, social, and environmental performance. Economic indicators alone have been used for performance measurement by about 40% of the reviewed literature. The rest of the reviewed literature has suggested combining three dimensions of sustainability. After a rigorous review of the 145 pieces of the stated literature, a list of economic indicators has been compiled and shown in Table 10. A conceptual framework for economic sustainability management has also been proposed and demonstrated in Figure 11.

3.4. Other Indicators

A supply network is created to satisfy various customers' needs; therefore, the networks have different issues for different regions. Hence, it is imperative to devise a few need-based sustainability dimensions for specific sectors. The House of Sustainability concept is proposed by [147] for the coal sector, which advocates including moral sustainability factors in dimensions of sustainability. Ethical sustainability is essential for companies to grow ethically and socially. Transparency sustainability is necessary for Food Supply Chains such as meat, milk, wine, frozen food, and perishable vegetables, while some authors have suggested technical and political sustainability and information transparency for the future sustainable dimensions [28,37,60].

Table 10. Economic indicators of SSCM.

S.No.	Component	Indicator
1	**Cost**	Inventory
2		Transportation
3		Facilities and Handling
4		Information
5		Productivity
6	**Service**	Response Time
7		Product Variety
8		Product Availability
9		Customer Experience
10		Time to Market
11		Order Visibility
12		Return Ability
13	**Financial**	Return on Investment
14		Return on Equity
15		Return on Assets
16		Accounts Payable Turnover

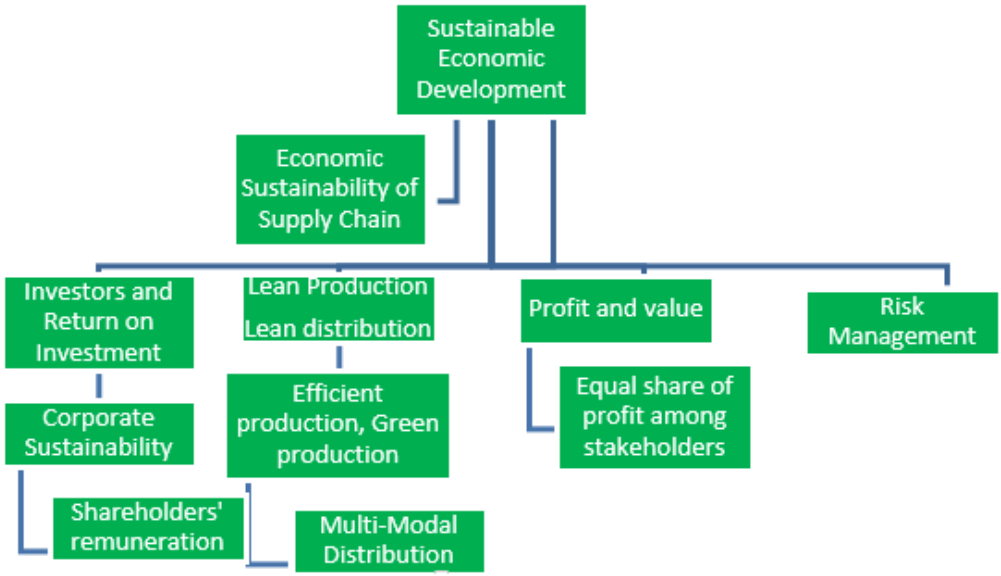

Figure 11. Economic Framework of Sustainable Development.

4. Discussions

From production to operations through end-of-life management, green supply chain management (GSCM) integrates the principle into conventional supply chains to create environmentally friendly processes (reduce, reuse, recycle, reclaim, and degrade). The goal of green supply chain management is to aid businesses in operating more sustainably and effectively. It is sometimes referred to as green logistics. The purpose of green SCM goes beyond only being environmentally friendly. Enhancing sustainability and increasing efficiency in operations are other important goals. The three pillars of sustainability—people, earth, and profits—are all considered by an all-encompassing green approach. It is evident from the literature that Green Supply Chain Management (GSCM) is a subset of Sustainable Supply Chain Management (SSCM), as SSCM covers all dimensions of sustainability [148].

Forty-eight percent of the reviewed literature has endorsed that SSCM could achieve sustainability goals proposed by the United Nations MDG report. A framework showing an association between sustainable development and SSCM is established in Figure 12.

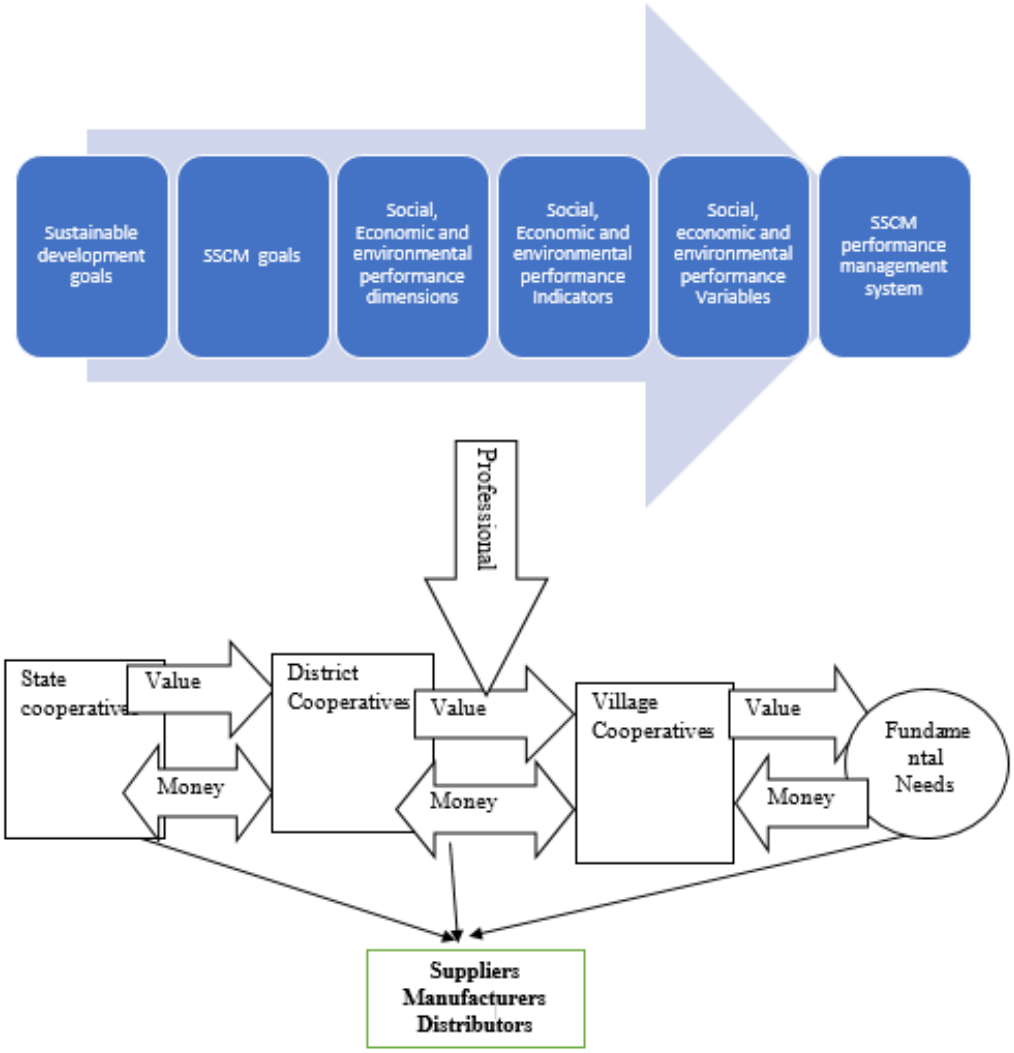

Figure 12. Sustainable development and SSCM.

4.1. Sustainable Development and SSCM

The research objective of this study is investigated through content analysis of the reviewed literature. Most of the literature that addresses the SSCM has mentioned sustainable development (80%). The impact of sustainability initiatives on other functions and capabilities of a supply chain has been studied and concluded to have a positive association with some lag, while some authors have shown a negative impact [52,58,67,106,149–152].

Social, environmental, and economic indicators and variables for SSCM are a subset of 300 indicators of sustainable development mentioned in the UN MDG Report 2015. Overall, the data and content analysis reveal that through SSCM and government and NGO initiatives, sustainable development could be achieved; a framework for achieving sustainable development is shown in Figure 12 and answers the RQ1. Moreover, a systemic process could be adopted to measure and manage SSCM, as shown in Figure 13. An SSCM Management System may contain performance measurement methods, matrices, and indices for different dimensions of social, economic, and environmental sustainability development.

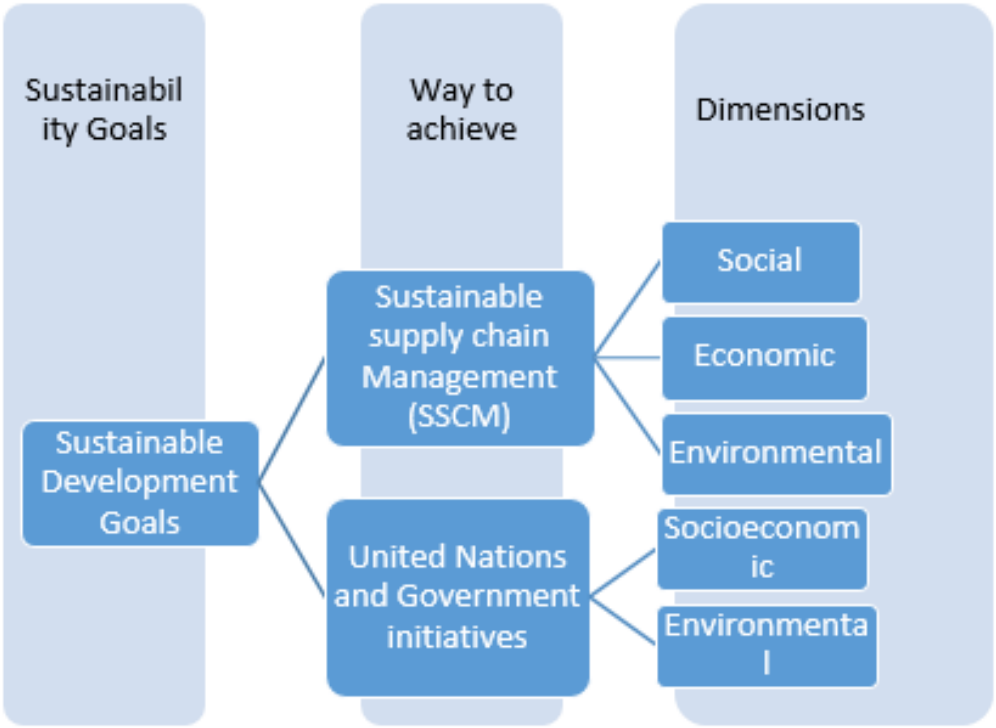

Figure 13. SSCM deployment process.

4.2. Deployment of SSCM

Ascertaining questions are still important, such as who is going to measure sustainability? What should be the appropriate framework for different sectors or entities of a supply chain? The solutions are unclear, and each stage of a supply network has another framework and sustainability indicators. Therefore, the SSCM deployment framework is proposed to address the above questions, as shown in Figure 12, and answers the RQ2.

Ref. [24] have proposed a four-stage QFD that is confusing and tedious to implement. Ref. [27] presented the Sustainability Deployment Function (SDF) based on customers' needs. However, while implementing this framework, there may be a possibility that some dimensions of sustainability may be ignored; therefore, it is essential to deploy the sustainability functions from the company's perspective, not from the customers' perspective.

Hence, the authors proposed a house of a sustainability framework; the proposed House of Sustainability framework may be easy to deploy for all stakeholders of a supply network. It allows the flexibility to choose specific sustainability indicators for their basket and requirement. The following steps could be adapted for the deployment of sustainability:

- Identify the sustainability indicators for the company using AHP, ISM, or some clustering tools;
- Each indicator has variables to measure or deploy, so identify the variables of each of the arrows;
- Construct the House of Sustainability similar to the House of Quality proposed by [147];
- Find out the suitable variables to deploy or report, or measure for the company using the following formula:

$$F_i = d_i \sum_{j=1}^{n} v_{ij}$$

Where
F_i = *total* impact score on ith *indicator*
d_i = Relative importance or weight of ith *sustainability indicator*
V_{ij} = impact of jth variable on ith sustainability Indicator

Considering the total impact score and the company's sustainability reporting strategy, the company should deploy the required sustainability indicators.

5. Conclusions, Limitation and Scope of Future Research

Existing reviews have focused on the practices of SSCM. This study has shown the road for the future in the SSCM area. Content analysis of the literature reviewed showed a positive association between sustainable development and Sustainable Supply Chain Management. The suggested framework demonstrates how various supply chain management stakeholders, including employees, suppliers, buyers, the government, and society, may work together to accomplish the sustainable development aim. Additionally, it aids in the achievement of the sustainable development goal through the use of sustainable supply chain management. The author argues that sustaining a supply network might lead to sustainability and suggests a comprehensive methodology for integrating sustainability indicators into a supply chain. In addition, the study provided a framework for using sustainability indicators.

The reviewed literature has also indicated the sharp growth of research on sustainability associated with SSCM. The United Nations' sustainability goals could be achieved through SSCM; hence, SSCM will also guide future research. The study proposes the 'House of Sustainability' framework for deploying sustainability. The proposed frameworks to achieve 17 SDG goals are formulated in this literature concerning SSCM for all three dimensions of sustainability. It has also been shown statistically that through SSCM practices, sustainability performance could be affected. A report piloted by Elsevier in collaboration with SciDev.Net (https://www.elsevier.com/__data/assets/pdf_file/0018/119061/SustainabilityScienceReport-Web.pdf (accessed on 20 September 2022)) has indicated a baseline in both the definition and the understanding of sustainability science. This report helps to follow its progression and trajectory. The report examines six key themes encompassing the 17 United Nations Sustainability Development Goals: Dignity, People, Prosperity, Planet, Justice, and Partnership. The key findings of the report are (https://www.elsevier.com/research-intelligence/resource-library/sustainability-2015 (accessed on 20 September 2022)):

- Sustainability science has a high growth rate (7.6%) in research output;
- Research output in sustainability science attracts 30% more citations than an average research paper;
- Research in sustainability science is highly collaborative;
- Sustainability science is less interdisciplinary than the world average.

The report has also indicated that the high growth rate is contributed mainly by developed countries, showing the collaboration between the northern and southern hemispheres. The key findings indicate the importance of the topic for the research; it also points out that it is less interdisciplinary and can expand. The analysis of this paper also presented the same story as the above report. Practitioners may create thorough and realistic strategies for their specific sectors using the author's suggested framework for a sustainable supply chain. Sustainability indicator deployment and sustainability reporting have different formats in different countries, and business entities along the supply chain face the challenge of deploying sustainability indicators.

Since the actual data for the developed framework in this study is based on published literature indexed in the SCOPUS database, we did not include any research in our analysis

that were not SCOPUS-indexed. Future studies, including publications indexed in other databases, should be looked into to gain a more comprehensive understanding of particular issues. In the future, by including the voice of supply chain managers of various firms and social media data, a more comprehensive framework and sustainability deployment mechanism can be developed to eliminate the grey areas of sustainability, DSCM, and sustainable supply chain management.

Funding: This research received no external funding.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The authors declare no conflict of interest.

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